

SYSTEM OF TWO-VARIABLE FIRST DEGREE INEQUALITIES

- A system of two-variable first degree inequalities is a system that can be written in the form:

$$\begin{cases} a_1x + b_1y \geq c_1 \\ a_2x + b_2y \geq c_2 \end{cases} \quad (\leq, >, <)$$

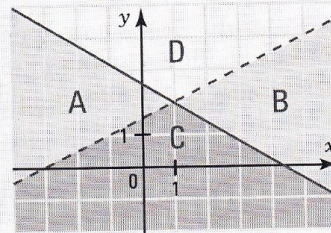
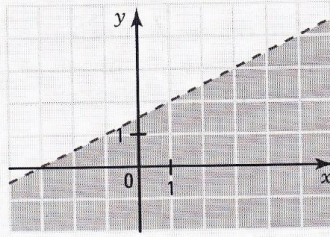
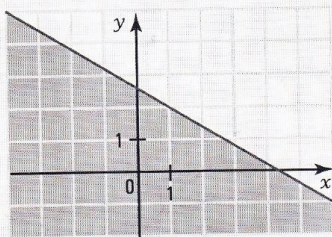
- The **solution set** of a system of two-variable first degree inequalities is obtained by determining the intersection of the solution sets of each of the inequalities of the system.

Ex.: To solve the system $\begin{cases} 3x + 5y \leq 13 \\ x > 2y - 3 \end{cases}$, we proceed in the following way:

- 1 We represent the solution set of the inequality: 2 We represent the solution set of the inequality: 3 We deduce the solution set of the system.

$$3x + 5y \leq 13$$

$$x > 2y - 3$$



Any point belonging to region A verifies inequality (1) only.

Any point belonging to region B verifies inequality (2) only.

Any point belonging to region D verifies neither inequality.

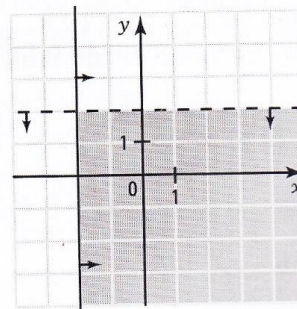
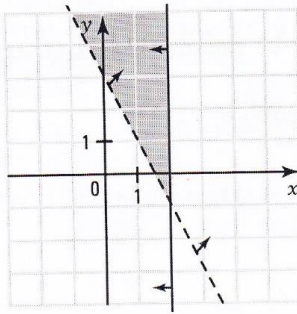
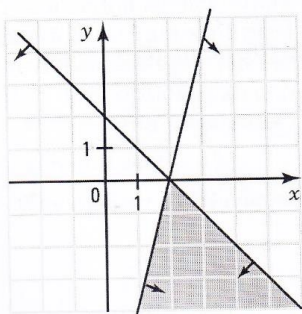
Any point belonging to region C verifies both inequalities simultaneously and represents the solution set of the system.

1. Determine graphically the solution set of the following systems.

a) $\begin{cases} -4x + y \leq -8 \\ x + y \leq 2 \end{cases}$

b) $\begin{cases} y > -2x + 3 \\ x \leq 2 \end{cases}$

c) $\begin{cases} x \geq -2 \\ y < 2 \end{cases}$

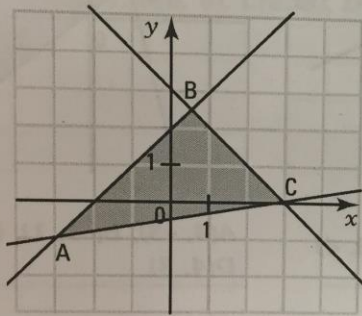


vertex, the appropriate system of equations.

Ex.: See activity 2

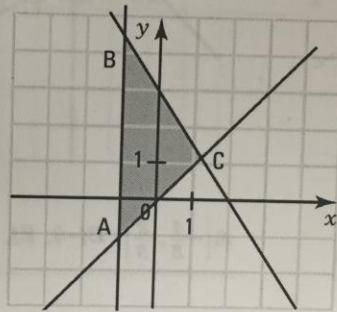
1. Determine the polygon of constraints corresponding to the solution set of each of the following systems of inequalities and find the coordinates of the polygon's vertices.

a) $y \leq x + 2$
 $x + y \leq 3$
 $x - 6y \leq 3$



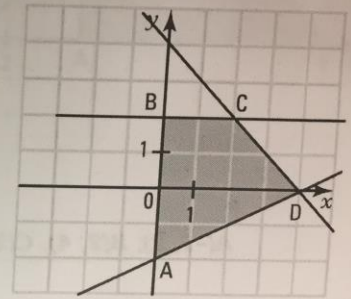
$A(-3, -1), B\left(\frac{1}{2}, \frac{5}{2}\right), C(3, 0)$

b) $3x + 2y \leq 6$
 $x \geq -1$
 $x - y \leq 0$



$A(-1, 1), B\left(-1, \frac{9}{2}\right), C\left(\frac{6}{5}, \frac{6}{5}\right)$

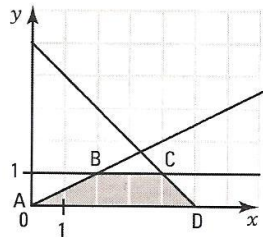
c) $y \leq -x + 4$
 $x - 2y \leq 4$
 $x \geq 0$
 $y \leq 2$



$A(0, -2), B(0, 2), C(2, 2), D(4, 0)$

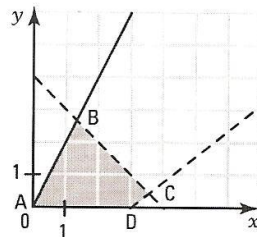
2. Determine the polygon of constraints corresponding to the solution set of each of the following systems of inequalities and find the coordinates of the polygon's vertices.

a) $x \geq 0$
 $y \geq 0$
 $x + y \leq 5$
 $x \geq 2y$
 $y \leq 1$



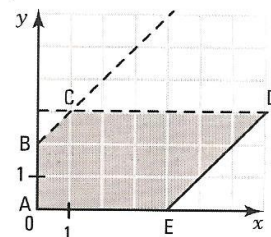
$A(0, 0), B(2, 1), C(4, 1), D(5, 0)$

b) $x \geq 0$
 $y \geq 0$
 $x - y > 3$
 $y \leq 2x$
 $x + y < 4$



$A(0, 0), B\left(\frac{4}{3}, \frac{8}{3}\right), C\left(\frac{7}{2}, \frac{1}{2}\right), D(3, 0)$

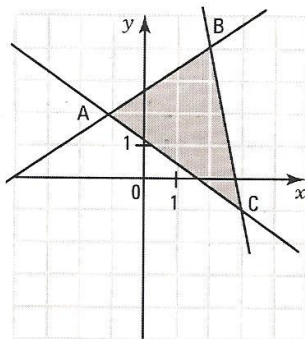
c) $x \geq 0$
 $y \geq 0$
 $x - y \leq 4$
 $y < x + 2$
 $y < 3$



$A(0, 0), B(0, 2), C(1, 3), D(7, 3), E(4, 0)$

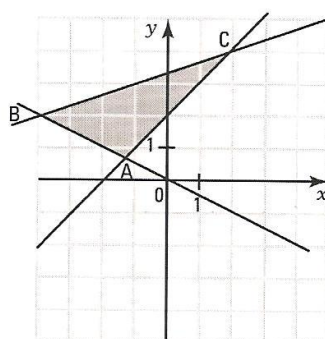
3. In each of the following cases, construct the polygon of constraints corresponding to the system of inequalities and determine, algebraically, the polygon of constraints' vertices.

a) $2x - 3y \geq -8$
 $5x + y \leq 14$
 $3x + 4y \geq 5$



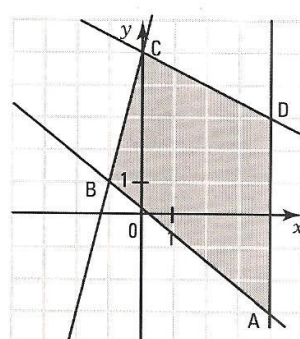
$A(-1, 2), B(2, 4), C(3, -1)$

b) $y \geq x + 2$
 $-x \leq 2y$
 $x - 3y \geq -10$



$A\left(-\frac{4}{3}, \frac{2}{3}\right), B(-4, 2), C(2, 4)$

c) $y \leq -\frac{1}{2}x + 5$
 $x \leq 4$
 $4x + 5y \geq 1$
 $y \leq 4x + 5$



$A(4, -3), B(-1, 1), C(0, 5), D(4, 3)$